

EXECUTIVE SUMMARY

Proposed Action and Alternatives

The U. S. Department of Energy (DOE), in this Environmental Assessment (EA), reports the results of an analysis of the potential environmental impacts from the proposed upgrade and operation of the Continuous Electron Beam Accelerator Facility (CEBAF) and Free-Electron Laser (FEL) accelerators and the construction and use of buildings associated with the 2005 Ten-Year Site Plan at the Thomas Jefferson National Accelerator Facility (TJNAF or Jefferson Lab) in Newport News, Virginia. Jefferson Lab is operated by the Jefferson Science Associates, LLC (JSA) under contract to DOE. (The Lab was operated by the Southeastern Universities Research Association, Inc. (SURA), until June 1, 2006, when JSA assumed the management and operation of the Lab.) DOE has chosen to base this EA on the Ten-Year Site Plan for Fiscal Year (FY) 2007 – FY 2016 prepared in 2005 rather than the 2004 Ten-Year Site Plan as denoted in the Environmental Assessment Determination (EAD) since it better reflects the Laboratory's planned and future activities.

With this proposal, DOE intends to: increase the current beam energy range of the CEBAF accelerator from a maximum energy of 8.0 GeV (Giga (billion) electron-volt) to 16.0 GeV and build expansions to the North and South Access Buildings and Service Building 98; construct a second Central Helium Liquefier (CHL) facility that would be connected to the current CHL; construct and use of a new experimental area, the Hall D complex, along with its counting house and associated service buildings; upgrade the FEL facility from the current 50 kW (kilowatt) maximum to provide 190 kW light beam power; excavate/construct two retention ponds; construct one Technical Support Building; construct a radioactive waste storage structure and several general site storage structures; expand the site utilities that serve the Accelerator Site (the fenced in area that encompasses both CEBAF and the FEL and their experimental areas) including the construction of a 10 megawatt (MW) generator pad; and the addition of a North Connector Road extension and parking lot. All of the projects and activities discussed within this EA are included in the Laboratory's 2005 Ten-Year Site Plan.

DOE proposes to take this action to provide Jefferson Lab an increased capability for accelerator and physics program operations. Since it began operation in 1995, CEBAF has enabled physics research to occur at Jefferson Lab and the use of CEBAF's continuous wave electron beam has led Jefferson Lab to play a world leadership role in hadronic physics, providing essential insights into the fundamental structure of matter. Maintaining the status quo and not performing the upgrade means that the U.S. Nuclear Physics program will lose its world leadership in the study of hadronic matter. Similar to CEBAF, if the proposed upgrade of FEL capabilities should fail to occur, the basic science community would also lose out on research opportunities involving such light sources.

In this EA, DOE presents the proposed action, as summarized above, the No Action alternative, and those alternatives to this proposed action which were considered and dismissed. It also evaluates the impacts of each in Section 4.

No Action Alternative

If No Action is taken to fund any of the projects noted on this proposal, DOE would continue operating CEBAF within a beam energy range up to 8.0 GeV and the FEL at its current light

beam power maximum, and Jefferson Lab would continue to function as effectively as possible by using existing buildings and structures. Without the CEBAF and FEL upgrades, the functionality of the Lab diminishes because the research reach is limited and will not be forefront. As well, for other identified projects, inefficiencies due to using nonoptimal work and storage spaces would continue.

Alternatives Considered and Dismissed

The use of another facility to perform this type of physics research was considered. There is no other CEBAF and there is no other such FEL. As well, the CEBAF and FEL accelerators can be upgraded easily and the site infrastructure is in place at Jefferson Lab. Thus, the use of alternative sites was not considered to be feasible.

For the accelerator and general facility support building actions and the drainage and transportation improvement actions, the selected Jefferson Lab sites appear to make the best use of the existing site infrastructure. These selections also limit disturbance, to the extent possible, to sites that are adjacent to existing structures or developed areas. As the most efficient and economical means to perform the functions have been studied carefully, these alternative means to accomplish the action and different sitings from those proposed were found not to be viable alternatives. Leasing offsite space to use to support operations is more expensive in the long run than operating federally owned buildings, and the proximity of staff and resources to onsite facilities would be inefficient in day-to-day operations.

Impacts for the Proposed Action and Alternatives

The findings of the impacts analysis of resources that could be affected by the proposed action or any of the alternatives, including No Action, are reported in this EA. Other resources or issues that are not considered in this EA, as they either do not apply to the site or there are no site issues involving them, include prime farmland, aesthetically important areas, scenic rivers, special natural resources such as aquifers, and Native American concerns. There are also no natural rivers, streams, or creeks present on the Jefferson Lab site, nor the opportunity for high water encroachment from nearby streams nor any State Natural Area Preserves. Thus, the impacts analysis in this EA, as summarized in the section entitled 'Impact Summary for the Proposed Action' below, focuses on the effects of accelerator operations, multiple construction projects, and changes in land use and building use due to additional operational requirements. This analysis looks at impacts to the environment, the workers, and the offsite public.

With No Action, the environmental effects of operating CEBAF and FEL at current levels and using existing facilities to support research would continue to be minimal, as the impacts have been over Jefferson Lab's years of operation as a research institution. Impacts for the alternatives considered would generally be more disruptive, such as more land disturbance, or more inefficient, such as greater distances to transport utilities and services, and longer times to travel to access needed supplies, than those identified for the proposed action.

Impact Summary for the Proposed Action

Environmental Impacts

Temporary Construction Impacts

As construction activities would be short-term and localized at the Jefferson Lab site, negligible to minimal impacts to the following resources are expected from this action: Geology and Soils, as almost all disturbance will be within a few feet of the surface; Floodplain, as the Jefferson Lab site is not within a 100-year floodplain; Cultural Resources, as provided by the Project Review Supervisor at the Commonwealth of Virginia Department of Historic Resources; Socioeconomics, as labor for proposed construction actions would be drawn from the local pool of tradesmen and women with only minimal additional staffing expected; and, Environmental Justice, since offsite impacts would be negligible from this proposed action.

Resources, where impacts could range from minimal to moderate, but would be limited for the duration of the construction and area stabilization, are summarized here. These impacts are fully presented in Section 4.

CEBAF, FEL, and Related Building and Equipment Operations

In general, the upgraded accelerators and their support buildings and equipment will either continue or begin to operate in the same manner as the current facility operates. As more support equipment will be needed to run the upgraded accelerators, there will be impacts due to increased resource (water and power) usage. The important potential impacts on resources as a result of CEBAF and FEL operations are discussed in Section 4.5.1 and their support facilities in 4.5.4. A brief synopsis of the potential impacts on resources follows.

Long-Term Land Use and Non-Accelerator Building Operations

The potential impacts on resources as a result of the proposed action are provided in Section 4. A brief synopsis is provided here.

There are a number of resources discussed under the Coastal Zone Management Act (CZMA) section. There are minor predicted long-term land use impacts to terrestrial resources due to general development, but no expected impacts on aquatic resources and wetlands as there are none in the affected area. Effects on storm water control, surface waters, and air quality could range from minimal to moderate. Considerations to optimize new buildings to operate in an environmentally sound manner are to be addressed during the planning stage. For long-term building and site maintenance and use, best management practices (BMPs), including environmentally sound landscaping and grounds maintenance practices, will be implemented to keep both the buildings and their support functions operating efficiently so that effects on all the above areas can be negated or minimized. These BMPs would also address resource management issues that are enforceable under this Act by taking the operational efficiencies and practical pollution prevention (P2) and waste management factors considered during the planning

stage and putting them into daily practice and use. Using integrated P2 strategies will help to minimize both the use and waste of resources to the extent possible.

The following information discusses the applicable program areas reviewed.

Socioeconomics: There will be a temporary increase in onsite labor during the construction of the proposed actions. This will span over a period of 6 to 8 years. On a project by project level, labor will be drawn from the local area pool by the respective subcontractor. There is a substantial amount of construction in the local area and an adequate pool of labor is expected to be available for the proposed construction. Labor for proposed modifications and operational changes would be drawn from the pool of JSA and subcontractor staff at Jefferson Lab. Therefore, impacts to the local population, services, and economy would not be expected. With regard to environmental justice, there would be no disproportionate adverse impacts on minority and economically disadvantaged populations in the Newport News area because no important adverse impacts are expected from any aspects of the proposed action.

Cultural Resources: The Project Review Supervisor at the Commonwealth of Virginia Department of Historic Resources has advised DOE that no adverse impacts to archaeological and historic resources would be expected from the proposed action.

Geology: The site geology was thoroughly reviewed in 1995 to support the change to the groundwater monitoring permit status from a construction project to an operating facility. As excavation is limited, the proposed construction activities should not affect site geology or soils. The planned hydrogeologic study to support the placement of new monitoring wells will be used to update site geologic conditions.

Land Use: The 40-acre fenced Accelerator Site, located on the south end of the DOE property, houses the CEBAF and FEL accelerators. Proposed activities would not alter the industrial nature of the site. Approximately 13 acres of land would be impacted during the construction of all projects, both on and off the Accelerator Site, and approximately 3 to 4 acres of this land would remain impervious as roads and facilities for the life of the facility. Both temporary and long-term impacts to soils due to the project would be minor. Impacts would include soil loss through erosion, compaction, and loss of structure in soils that are disturbed or driven on during construction.

Transportation and Traffic: Although the topics Traffic and Transportation do not apply under the CZMA, they were also reviewed for impacts. Additional public and site roads will have increased use during the construction activities. Through optimizing parking and transportation layouts during the planning process, any additional site traffic considerations will not impact the environment more than at present. Thus, no significant impacts are expected.

Noise: Local construction noise would exceed ambient noise levels and may be heard for some distance within the project area. Normal building and equipment functioning produces noise as is typical on the Jefferson Lab site. Given the urban nature of the site and its vicinity, noise from operations would not be unique. While noise from operating equipment and traffic would regularly be perceptible in nearby areas, no adverse effects on human hearing would occur. Noise stemming from operating equipment such as compressors will be limited to interior building areas and is addressed as a worker health and safety issue below.

Floodplain/Wetlands: The DOE site is not within a 100-year floodplain, so no such floodplain areas will be affected by this action. From previous studies and reviews by the U.S. Army Corps of Engineers, the only identified wetland area on site will not be disturbed by this action, so there will be no impact on any potential wetland area.

Endangered Species: In accordance with Endangered Species Act requirements, DOE informally consulted with the U.S. Fish and Wildlife Service and the Commonwealth of Virginia Department of Game and Inland Fisheries, Department of Agriculture and Consumer Services, and Bureau of Plant Protection for comment on the proposed actions. No adverse impacts to protected species and/or habitat would be expected from the proposed action.

Spill Potential: The requirements for implementing spill prevention and control practices would be incorporated into applicable subcontract specifications. For day to day operations, Jefferson Lab applies both engineering and administrative controls to reduce the potential of a spill or release. These programs and procedures will be adapted to cover any new potential spill sources.

Groundwater Dewatering: Temporary construction dewatering at excavations will likely be necessary, but as this type of activity will be short term, only minimal impacts from this activity will occur, and controls incorporated into applicable subcontract specifications. Completion of this action will not have an impact on the flow quantity at the groundwater dewatering operation at the experimental halls. No impacts from radiation are expected, as discussed in the Radiological Impacts section titled Groundwater below.

Water Quality: The only expected impacts on water quality due to accelerator operations will be radiological, so there should be no non-radiological impacts on local surface or ground water, including from the dewatering effluent.

Surface Water – Impacts not Involving Radiation

Erosion and sedimentation to onsite storm water channels and storm drainage systems, including at local roadways, could result from land disturbances during onsite construction activities and would be controlled by implementing standard erosion control measures, as specified in construction subcontracts, until stabilization is complete.

Further development on the DOE site could result in minimal to moderate offsite impacts to surface water if changes in storm water flows are not mitigated. The retention ponds being added under this action will incorporate recommended measures that would offset impacts due to this action and other potential facility growth, and should negate or minimize any offsite impacts.

Impacts from radiation from this action are not expected, as discussed in the Radiological Impacts section titled Surface Water below.

Radiological Impacts – All Waters That Could Be Affected by Radiation

Generally, radiological effects on groundwater and surface water from upgraded CEBAF operations, including at the three existing experimental halls, Hall A, Hall B, and Hall C, and at the new Hall D, will continue to have the potential for minor impacts to ground and surface waters. Impacts to ground and surface water from upgraded FEL operations will be negligible. The effects on surface waters include negligible impacts from the controlled discharges of activated waters to the local sanitary sewer system. Any impacts will be mitigated as presented in Section 4.4.2.2 and are briefly described below.

Groundwater

As operational levels will change, appropriate shielding will be installed, including at both Halls A and C at their high power beam dumps (HPBDs), to reduce the probability of impacting groundwater. Negligible impacts on soils or groundwater in the vicinity of the accelerator or near any of the halls from prompt radiation are expected.

Process Water

The generation of radioactive wastewater from various sources is expected to slightly increase with CEBAF accelerator operation under the proposed parameters. This water will be managed under the current program using the controlled discharge of small quantities to the public sewer system, and ultimately to surface waters, in accordance with the Lab's Hampton Roads Sanitation District (HRSD) permit.

Because these increased levels of activity can be managed under the current site program, no additional impacts for addressing this activated process water are projected for operation under the proposed parameters. Materials that would be collected for discharge that are outside of permit criteria would be disposed under controlled conditions as low level activated waste, a minimal, not expected, impact.

Surface Water, Including That to the Sanitary Sewer System

The only potential radiological impacts to the surface water are from accelerator sump pumps located throughout the accelerator complex, from the groundwater dewatering activity at the halls described in Section 4.4.3.1, and from the indirect discharges of activated water to the sanitary sewer mentioned above. The

water from the accelerator area sumps is collected, and if it does not meet standard surface release requirements, is disposed off site as activated water. Discharges from any new facilities would be managed under current site programs. As all releases to the surface are managed under current programs, there would be only minimal additional impacts to surface water from the possible increased quantities of activated water, as defined in permit limits, released to the sanitary sewer.

Air Quality: The operation of construction equipment and vehicles on site would produce air emissions common to construction sites and localized near the site of operation. Contribution from the proposed action to offsite concentrations of regulated non-radiological air pollutants, such as dust particulates, would be minimal. Precautions to limit fugitive dust emissions outlined in 9 VAC 5-50-60 et. seq. will be taken into account during site activities. During construction required precautions will be included in subcontractor specifications and, during normal facility operations, procedures are already in place to limit emissions.

The operation of CEBAF above 8.0 GeV will result in minimal effects on the air quality within the CEBAF accelerator tunnel or experimental halls and negligible effects at the new Hall D complex. This will also apply outside the Accelerator Site and at the site boundary. Programs required under the National Emission Standards for Hazardous Air Pollutants (NESHAPs) in the Code of Federal Regulations (CFR) Subpart H of 40 CFR 61 will be administered to meet regulatory and DOE requirements.

The operation of the upgraded FEL will result in no additional radiological effects within the FEL tunnel or at the site boundary.

Under this proposed action to upgrade the two accelerators, the radiological impacts will be minimal but will continue to be managed as done under current site programs to remain As Low As Reasonably Achievable (ALARA).

Waste Generation: There will be a temporary increase in waste generation due to construction activities; however, subcontractors would be encouraged to minimize waste generation through subcontract specifications. During operations, building and accelerator, only minor increases in the quantities of sanitary and radioactive wastes generated from this proposed action are expected. The Lab encourages recycling in all site activities. All waste and recyclable materials management issues are addressed in current programs as well as in the Jefferson Lab Environment, Health & Safety (EH&S) Manual.

Pollution Prevention: General P2 considerations, that include waste minimization, energy efficiency, and environmentally preferable purchasing (EPP), will be taken into account during the design and construction of the proposed buildings. Building and accelerator operations will incorporate P2 considerations into the design and operations to the extent possible.

Resource Usage: Generally, the increase in the demand for power and water to support upgraded accelerator operations will have the potential for moderate impacts to local utility resources. All will be mitigated and/or further researched as described in detail in Section 4.4.10. The need for additional supplies of power and water and cryogens for cooling will be substantial but is well supported by offsite systems, and the increased resource demand will be mitigated by further exploring and using alternative sources, such as treated wastewater and state of the art equipment that should reduce loading factors.

Health and Safety Impacts

The expected level of impact regarding safety and health concerns for each of the identified activities has been evaluated for this proposed action.

Construction Hazards: The hazards of note during construction will be typical for this type of activity, such as working on elevated areas and electrical safety. There will be no more impact than that at any typical construction project.

Radiological Impacts: Most of the occupational radiation exposure at Jefferson Lab would continue to occur during maintenance activities on activated components. The level of induced radioactivity in the components is directly proportional to the amount of electron beam power lost in the components. CEBAF operation at energies up to 16.0 GeV would result in potential beam power loss to the same maximum level as current up to 8.0 GeV operations (i.e., 1 MW in either Hall A or Hall C). Consequently, changes in beam energy, as proposed, are not expected to increase occupational radiation exposure.

The chief source of radiation exposure for members of the general public is “skyshine” radiation. An analysis of skyshine production mechanisms for electron beam energy of 16.0 GeV has shown that the increased number of neutrons directed toward the roof from beam loss at the target region will be offset by the reduction of beam loss from the target region to the HPBD areas in each experiment hall. As a result the general public exposure should remain constant for an increase in energy from 8.0 GeV to 16.0 GeV.

The public may be exposed to small quantities of radioactivity induced in air in the CEBAF enclosure as a result of nominal ventilation during routine operations. The production of ozone, oxides of nitrogen, and radioactive gases by CEBAF operation, including in the experiment halls, the primary gas generation areas, has been shown to be directly proportional to the amount of beam power loss. Because beam power loss in the experiment halls is expected to remain similar to that occurring at current operating energies, the amount of ozone, nitrogen oxides, and radioactive gases will remain at approximately the same level under the proposed action.

The safety and health impacts to workers and the public due to radiological activity resulting from Hall D operation are very low, as this is a low hazard machine and will

involve using the same type of controls and support equipment that is currently in use at Jefferson Lab.

Noise: Noise impacts on those working in new high noise work areas will be the same as those in current areas. Health and safety mitigation measures are found in current Lab programs and procedures.

Non-Radiological Impacts: Non-radiological hazards associated with the proposed action include electrical, chemical, and non-ionizing radiation (lasers), which could injure and, in extreme cases, can be potentially fatal to occupational workers. Engineering controls, as well as administrative procedures specified in the Jefferson Lab EH&S Manual, are used by the Lab to minimize the potential for accidents involving electricity, chemicals, and lasers. Special controls will be used to reduce the chances of the FEL's outdoor laser light beam from making contact with flying objects or any people working at that height.

Cumulative Impacts

Cumulative environment, health, and safety impacts are those which result from the incremental contribution from each effect discussed above along with impacts expected from other past, ongoing, or planned actions within the same geographic area.

Both on and off site major construction activities will have temporary and long term site related impacts. Onsite construction actions would be managed to keep impacts to a minimum, but DOE has no control over offsite activities.

CEBAF and the FEL will be operated within their proposed or specified operating limits and within identified site limits to minimize cumulative impacts to the environment, occupational health factors, and public health and safety concerns. The minimal to moderate radiation-related impacts related to CEBAF operations and the minimal impacts related to FEL operations will be long term, but will also be managed to minimize any impacts as reported in this EA. The radiological impact of the action proposed in this EA will be offset by factors such as radioactive decay and engineering and administrative controls. Radioactivity levels will remain substantially below permit limits and, therefore, any changes that are not inconsequential will be anticipated and mitigated so that effects on the environmental and public health conditions are not affected beyond those under current operations. There will be no cumulative impacts involving radioactivity from the combination of operating the upgraded CEBAF and FEL accelerators simultaneously. CEBAF and the FEL will be operated within their proposed or specified operating limits and within identified site limits to minimize cumulative impacts to the environment, occupational health factors, and public health and safety concerns.

As for non-radiological environment, health, and safety related operational impacts, the routine operation and use of the new experimental hall, the upgraded accelerators and existing experimental halls, and the other new DOE facilities would be managed to keep impacts to a minimum, as is done to the extent possible for existing accelerator and site building operation.

It is anticipated that any development on the adjacent SURA and City properties would also be managed to keep impacts to a minimum and to result in no impact to the DOE site. The long-term effects from the impervious cover on site have already been analyzed and BMPs have been identified to minimize onsite effects and to not affect offsite properties.

Thus, there would be cumulative impacts when taking into account the construction, operation, and use of the new buildings and the operation of the upgraded CEBAF and FEL accelerators when combined with the other impacts from beyond the site boundaries, though none of these activities would have major impacts on occupational and public health and safety.